AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions of claims in the application:

Listing of Claims:

1. (Currently amended) An integrated rotary-linear actuator system, comprising:

a plunger movable along and rotatable about a longitudinal axis extending through the plunger, the plunger is supported against a motor support via bearings, the plunger comprises an array of magnets arranged on one of an outside surface of the plunger and an inside surface of the motor support, which supports the plunger to permit movement thereof;

a coil system having two sets of coils arranged to, when energized, interact with the plunger, the first set of coils embedded in a resin and being operative to provide an electric field to effect movement of the plunger in a linear mode, the second set of coils being operative to effect movement of the plunger in a rotational mode~~, the first set of coils positioned on the motor support and the second set of coils located on the plunger~~;

an amplifier coupled to the coils and operative to provide electrical energy to energize the coils; ~~and~~

a control system integrated with the amplifier, the control system having a network interface operative to receive control information, the control system being operative to control the amplifier to selectively energize the coils to effect desired movement of the plunger based on the control information received via the network interface, the control system and an associated rotary-linear motor are integrated into a single module;

an encoder system coupled to the control system for determining the position of the plunger, the encoder system is affixed to a surface of the array of magnets and etched with a pattern of reflective and non-reflective regions that are scanned by optical pickups to register movement of the plunger,

wherein the control system controls the amplifier and, in turn, controls energization of each phase of the coils based on the position information from the encoder system so as to effect desired movement of the plunger.

2. (Canceled)

3. (Currently amended) The system of claim 1 ~~2~~, the first set of coils are arranged to apply an axial force on the array of magnets to drive the plunger in the linear mode and the second set of coils arranged to apply a tangential force on the array of magnets to drive the plunger in the rotational mode.

4. (Currently amended) The system of claim 1 ~~2~~, the motor support comprises a bearing support and a housing that define a well operative to receive the plunger, the plunger being supported by a bearing located between the plunger and the bearing support, such that the plunger is axially movable along the longitudinal axis between a retracted position and an extended position and rotatable about the longitudinal axis.

5. (Canceled)

6. (Previously Presented) The system of claim 1, the amplifier further comprises first and second amplifiers, each being operative to provide electrical energy to a respective one of the first and second coils.

7. (Original) The system of claim 1 in combination with a network to which the network interface is coupled, the combination further comprising a computer operative to communicate the control information to the control system *via* the network interface using a network protocol.

8. (Previously Presented) The combination of claim 7, the control information includes program data to program operating characteristics of at least part of the integrated rotary-linear actuator system.

9. (Previously Presented) The combination of claim 7, the integrated rotary-linear actuator system further comprises at least one sensor operative to sense a condition of the integrated rotary-linear actuator system and provide a sensor signal indicative thereof, the control system being

operative to communicate condition data based on the sensor signal to the computer via the network interface using the network protocol.

10. (Previously Presented) The combination of claim 9, the control information includes program data operative to program operating characteristics of at least part of the integrated rotary-linear actuator system based on evaluation of the condition data from the integrated rotary-linear actuator system.

11. (Currently amended) A rotary-linear actuator system, comprising:

a motor support having a well;

a plunger supported for movement via bearings in at least part of the well so as to enable axial movement of the plunger relative to the well along a longitudinal axis of the plunger and rotational movement of the plunger about the longitudinal axis;

an array of permanent magnets associated with the plunger, half of the magnets are oriented such that their north poles point radially outward and the other half such that their north poles point radially inward, the array arranged as alternating columns of alternating polarity;

a first set of coils arranged to, when energized, apply an electric field that interacts with the array of magnets and provides an axial force to drive the plunger element in a linear mode;

a second set of coils arranged to, when energized, apply an electric field that interacts with the array of magnets and provides a tangential force to drive the plunger element in a rotational mode; ~~and~~

an integrated control system having a network interface operative to receive control information via an associated network, the control system comprising an amplifier coupled to the first and second sets of coils and being operative to selectively energize the first and second sets of coils to effect movement of the plunger in at least one of the linear and rotational modes, the integrated control system and an associated rotary-linear motor are integrated into a single module; and

an encoder system coupled to the integrated control system for determining the position of the plunger, the encoder system is affixed to a surface of the array of permanent magnets and etched with a pattern of reflective and non-reflective regions that are scanned by optical pickups to register movement of the plunger,

wherein the control system controls the amplifier and, in turn, controls energization of each phase of the first and second sets of coils based on the position information from the encoder system so as to effect desired movement of the plunger.

12. (Previously Presented) The system of claim 11, further comprising a computer operative to communicate the control information to the control system via the associated network using a network protocol.

13. (Previously Presented) The system of claim 12, the control information includes program data having executable instructions to program the control system to effect desired operating characteristics of the rotary-linear actuator system.

14. (Previously Presented) The system of claim 12, the rotary-linear actuator system further comprises at least one sensor operative to sense a condition of the rotary-linear actuator system and provide a sensor signal indicative thereof, the control system being operative to communicate condition data based on the sensor signal to the computer via the associated network using the network protocol.

15. (Previously Presented) The system of claim 14, the control information includes program data to program operating characteristics of at least part of the integrated rotary-linear actuator system based on evaluation of the condition data from the integrated rotary-linear actuator system.

16. (Currently amended) An integrated rotary-linear actuator system, comprising:

means for supporting a plurality of motors including means for supporting a bearing, the means for supporting the plurality of motors and the means for supporting the bearing defining a well;

means for moving a stage and adapted to be received by the well, the means for moving the stage being axially movable along its longitudinal axis between retracted and extended conditions and rotatable about its longitudinal axis, the means for moving the stage being supported by a bearing located between the means for moving the stage and the means for supporting the bearing;

means for providing a magnetic field arranged on the means for moving the stage, the means for providing the magnetic field constructed as a mesh with alternating rows of polarity;

means for applying a substantially axial force on the means for providing the magnetic field and driving the means for moving the stage linearly, the means for applying a substantially axial force embedded in a resin;

means for applying a substantially tangential force on the means for providing the magnetic field for the means for moving the stage rotationally;

means for amplifying an electrical signal and providing the amplified signal to at least one of the means for applying; ~~and~~

control means for controlling the means for amplifying, the control means including means for interfacing with an associated network and receiving control information to program the control means to control the means for amplifying to selectively activate the means for applying, and transmitting diagnostic information to at least one computer associated with the network, the control means and an associated motor are integrated into a single module; and

means for determining the position of the plunger, the means for determining the position of the plunger is affixed to a surface of the magnet field and etched with a pattern of reflective and non-reflective regions that are scanned by optical pickups to register movement of the means for supporting a plurality of motors.

17. (Currently amended) A method for controlling an integrated rotary-linear actuator system, the rotary-linear actuator system including a control system and an associated rotary-linear motor integrated into one module, the control system including a network interface to enable communication over an associated network, the method comprising:

receiving control information at the network interface of the integrated rotary-linear actuator system *via* the associated network;

programming operating parameters of the rotary-linear actuator system based on the received control information; ~~and~~

controlling an amplifier to selectively energize two sets of coils of the rotary-linear actuator system according to the programmed operating parameters, such that a plunger, which is moveable linearly and rotationally about a longitudinal axis thereof, moves in at least one of a linear and rotational direction, the linear direction in response to the energization of a first set of coils, and

the rotational direction in response to the energization of a second set of coils, the plunger comprises an array of magnets arranged on one of an outside surface of the plunger and an inside surface of a motor support, which supports the plunger to permit movement thereof, ~~the first set of coils positioned on an outside surface of the plunger and the second set of coils positioned on an inside surface of a motor support;~~

determining the position of the plunger via an encoder system affixed to a surface of the array of magnets and etched with a pattern of reflective and non-reflective regions that are scanned by optical pickups to register movement of the plunger; and

controlling energization of each phase of the two sets of coils based on the position information from the encoder system so as to effect desired movement of the plunger.

18. (Previously Presented) The method of claim 17, the control information is communicated from a remote computer *via* the network interface using a network protocol.

19. (Previously Presented) The method of claim 17, the control information includes program data, the operating parameters of the rotary-linear actuator system being programmed based on the program data.

20. (Original) The method of claim 18, further comprising:

sensing at least one condition of the integrated rotary-linear actuator system;

providing a sensor signal indicative of the sensed at least one condition; and

sending condition data from the integrated rotary-linear actuator system to the computer via the network interface using the network protocol, the condition data being based on the sensor signal.

21. (Previously Presented) The method of claim 20, the control information includes program data to program the operating parameters of at least part of the integrated rotary-linear actuator system based on evaluation of the condition data sent from the integrated rotary-linear actuator system.

22. (Currently amended) An integrated rotary-linear actuator system, comprising:

a plunger movable along and rotatable about a longitudinal axis extending through the plunger, wherein the plunger includes an inner and an outer cylindrical portion, both open at one end, with permanent magnets attached to the inner walls of the inner and outer cylindrical portions, the permanent magnets arranged in rows of alternating polarity;

air bearings supporting the plunger against an actuator support stage;

a coil system having coils arranged to, when energized, interact with the magnets attached to the plunger to move the plunger in a rotational mode and/or a linear mode;

an amplifier coupled to the coils to provide electric energy to the coils;

a control system and a network interface integrated into a single module, the control system integrated with a rotary-linear actuator, the network interface receiving and transmitting at least one of control and diagnostic information to an associated network; and

an encoder system coupled to the control system for determining the position of the plunger integrated into a single module with the actuator, the encoder system is affixed to a surface of the permanent magnets and etched with a pattern of reflective and non-reflective regions that are scanned by optical pickups to register movement of the plunger,

wherein the control system controls the amplifier and, in turn, controls energization of each phase of the coils based on the position information from the encoder system so as to effect desired movement of the plunger.

23. (Canceled)

24. (Previously Presented) The system of claim 22, further comprising a computer to communicate control information to the control system via the associated network.

25. (Previously Presented) The system of claim 24, the computer retrieves diagnostic information related to the health of the actuator via the associated network.

26. (Previously Presented) The system of claim 24, the computer is connected to a remote computer over the Internet.

27. (Previously Presented) The system of claim 26, the remote computer is operable to send calibration and/or maintenance program data to the actuator system.